



## CERTIFICATE OF VERIFICATION

I, Su Hyun LEE of 648-23 Yeoksam-dong, Kangnam-ku, Seoul, Korea state that the attached document is a true and complete translation to the best of my knowledge of the Korean-English language and that the writings contained in the following pages are correct English translations of the specifications and claims of the Korean Patent Application No. P2003-019582.

Dated this 13th day of September 2005

Signature of translator: 

Su Hyun LEE



[ABSTRACT OF THE DISCLOSURE]

03-19582

[ABSTRACT]

An LCD device with a digitizer and a method for manufacturing the same is  
5 disclosed, to obtain thin profile and lightness of the LCD device, and to improve yield,  
in which the LCD device with a digitizer includes a support main receiving an LCD  
panel for displaying image, and a backlight for providing light to the LCD panel; a lamp  
for emitting light, provided at one inner side of the support main; a light-guiding plate,  
provided adjacent to the lamp, for uniformly irradiating the light emitted from the lamp  
10 to an upper side; a digitizer having an upper surface of reflecting means, provided  
below the light-guiding plate; and a lamp housing having one opening adjacent to the  
light-guiding plate, provided in state of surrounding the lamp, wherein each one end of  
the light-guiding plate and the digitizer is inserted to the opening of the lamp housing.

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[TYPICAL DRAWINGS]

FIG 4

20 [INDEX]

liquid crystal display device, digitizer, lamp housing, reflecting means

**[SPECIFICATION]**

**[TITLE OF THE INVENTION]**

LIQUID CRYSTAL DISPLAY DEVICE WITH DIGITIZER AND METHOD  
FOR MANUFACTURING THE SAME

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**[BRIEF DESCRIPTION OF THE DRAWINGS]**

FIG. 1 is an exploded perspective view for illustrating a general LCM.

FIG. 2 is a block diagram for illustrating a driving circuit and method of a general electromagnetic EM type digitizer.

10 FIG. 3 is a schematic view for illustrating a digitizer mounted to the rear of an LCM according to the related art.

FIG. 4 is a cross sectional view illustrating an LCM to which a digitizer having a reflecting means is mounted.

15 \*Description of reference numerals for main parts in the drawings\*

12a: light-guiding plate

13: support main

26: lamp housing

40: digitizer

40a: reflecting means

20 **[DETAILED DESCRIPTION OF THE INVENTION]**

**[OBJECT OF THE INVENTION]**

**[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]**

The present invention relates to a liquid crystal display (LCD) device, and more particularly, an LCD device with a digitizer and a method for manufacturing the

same.

With resolution of a liquid crystal display (hereinafter, referred to as "LCD") has been rapidly developed by an improvement of liquid crystal materials and micro fabrication technology with characteristics of lightweight, filed emission display and 5 power consumption of electricity. Also, a range of application is becoming broader. For example, the LCD is used as a display device of a notebook personal computer (hereinafter, referred to as "NTPC"). The NTPC is slim and lightweight to use information between users. Among video display devices applied to various display devices, particularly, a liquid crystal module (hereinafter, referred to as "LCM") 10 including a backlight unit and a liquid display panel, which is a flat-panel display will be explained.

FIG. 1 is an exploded view of a general liquid crystal display module LCM 10. As shown in FIG. 1, the LCM 10 includes a backlight 12 and an LCD panel 11. The backlight 12 and the LCD panel 11 are supported by a support main 13 and a top case 15 20. At this time, a reflecting plate 12a, a light-guiding plate 12b, a first diffusing or protecting sheet 12c, a first prism sheet 12d, a second prism sheet 12e, a second diffusing or protecting sheet 12f and the LCD panel 11 are stacked up on top of the support main 13 of plastic material in order. Meanwhile, an upper side of the LCD panel 11 is connected to the top case 20 of the metal material, and a lower side of the 20 LCD panel is supported by the support main 13. Herein, the backlight including the reflecting plate 12a, the light-guiding plate 12b and the sheets is a lower unit of the LCM 10 for uniformly irradiating light to the LCD panel. At this time, the reflecting plate 12a is an independent component, which is mounted to the lowest part of the support main 13. That is, the upper surface of the reflecting plate 12a is formed of a

reflecting layer, and the lower surface of the reflecting plate 12a is formed of a support material having the predetermined stiffness. Accordingly, the reflecting plate 12a has the predetermined thickness. In the meantime, as shown in the drawings, a lamp 25 is provided at one side of a long-axis direction of the support main 13, wherein the lamp

5 25 serves as a light source.

Recently, high resolution of the LCD device is realized with a great improvement of LCD technology and a high-resolution graphic work is realized. Therefore, a digitizer is used as an input device in a computer having the aforementioned LCD device as well. The digitizer of the LCD device is classified into

10 a resistive type, electrostatic capacitance type and EM (electro-magnetic) type according to the method of searching a user-directed location.

At this time, the resistive type senses a location being pressed by pressure through a change of an amount of an electric current in a condition that the direct current voltage is obtained. Also, the electrostatic capacitance type senses the pressed

15 location by using capacitance coupling in a condition that the alternating current voltage is obtained. The electro-magnetic type sensed the pressed location by detecting a resonance frequency in a condition that a magnetic field is obtained.

Generally, the EM type digitizer is comprised of a digitizer plate having a sensor grid. In this case, a puck, a pen or a stylus is used to sense the location on the

20 digitizer.

FIG 2 is a block diagram illustrating a driving circuit and a driving method of an EM type digitizer according to the related art.

As shown in FIG 2, a digitizer plate (hereinafter, referred to as a 'digitizer') 40 includes X-axis and Y-axis coil arrays and X-MUX and Y-MUX coupled to the X-

axis and Y-axis, respectively. A specified Y-axis coil is selected by a Y address signal (Y-ADDR), a specified X-axis coil is selected by an X address signal (X-ADDR) for reading. Both X and Y address signals are generated from the controller 15.

The output signals from the selected Y-axis coil and X-axis coil are provided  
5 to the controller 15. The controller 15 includes an amplifier 34 for grading and amplifying the output signals, a wave detector 35, a low pass filter LPF 36, a sample and hold unit S/H 37, and an analog-digital converter 38. At this time, the output signals of the amplifier 34 are provided to the analog-digital converter 38 through the wave detector 35, the low pass filter 36 and the sample and hold unit 37.

10 The analog-digital converter 38 converts the size and polarity of an analog signal to a digital format, and then outputs the digital format to a processor 33.

The output signal of the amplifier 34 is supplied to the wave detector 35, and then supplied to the low pass filter 36 and the sample and hold unit 37.

15 While the analog-digital converter 38 is digitizing, the sample and hold unit 37 holds a measured value of a coil and a second following coil measurement is started at a front circuit.

The digitizer 40 includes a plurality of coils being piled up on a flexible surface of the PCB. Each coil is arrayed against X-axis and Y-axis, and has a first side being connected to a grounding voltage and a second side being connected to a mux unit  
20 in which one coil is chosen to be connected to an electric potential line of a fixed level.

In a hand-in state with an electronic pan 39 by a user, a sine wave current 32 is generated from a sine wave generator 31 under control of the processor 33, and then the sine wave current 32 is applied to the electronic pan 39, whereby a sine wave magnetic flux generates around the electronic pan 39.

At this time, when the user positions the electronic pen 39 on the digitizer 40, each sine wave voltage in different sizes is induced to each coil arranged on the digitizer 40 according to the position of the electronic pen 39, whereby the sine wave voltage is inputted to a CPU through the wave detector 35 and the analog-digital converter 38.

5 After that, the CPU 33 calculates the value of the position of the electronic pen 39 on the digitizer 40 from the value induced to a coil and outputs the angle value between 0° and 360°. The output data of the electronic pen 39 is induced to the liquid crystal display panel or stored in the CPU.

It is more convenient for a user to draw a figure when an area of the  
10 electromagnetic digitizer is larger and more efficient when the resolution is higher. The resolution is inverse proportion to spaces between coils in the digitizer 40. That is, when the spaces between the coils are narrower, the resolution becomes higher.

In the EM type, a plurality of coils are provided inside the digitizer 40, so that it is possible to detect the touching point of the electron pen 39 by detecting electric  
15 changes. Accordingly, unlike the resistive type, it is not required to mount the digitizer at the front of the LCD panel in the EL type. That is, the digitizer of the EM type may be mounted at the rear of the LCM 10. In case the LCM 10 having electromagnet connection characteristics is formed, it is possible to detect the touching point of the electron pen even though the digitizer 40 is positioned below the LCM 10.

20 In general, a printed circuit board (hereinafter, referred to as PCB) is provided at the bottom of the support main in the rear of the LCD device. A drive integrated circuit (hereinafter, referred to as D-IC) for driving switching devices (TFT array) of the LCM 10 on the PCB. And, the LCM 10 and the PCB having the D-IC are electrically connected by a tape carrier package (hereinafter, referred to as TCP) so as to send a

control signal of the D-ICs (a gate line driving signal) and a video signal (a data line driving signal) to each gate and data line of the LCD panel.

When the digitizer is provided at the rear of the LCM, it is desirable that the electro-magnetically uniform LCM is arrayed on a top surface of the digitizer and  
5 materials not being an electro-magnetically uniform formed in an irregular form such as PCB is provided on a lower surface of the digitizer.

FIG. 3 schematically illustrates the digitizer mounted at the rear of the LCM.

As shown in FIG. 3, when assembling a digitizer in a Table PC (EM Type)  
according to the related art, the digitizer is inserted between a support main 13 provided  
10 at the rear of the LCM and S,G-PCB (45, Source, Gate Printed Circuit Board) after the  
LCM 10 is assembled. When inserting the digitizer, as shown in FIG. 3, the digitizer  
should be lifted upward and fix the digitizer at a place to reduce a damage of the S,G-  
PCB 45 and the TCP 14.

When the digitizer 40 is fixed, in case of having S,G PCB 45, as the inserted  
15 digitizer is in contact with the S,G-PCB 45 and the TCP, thereby increasing the damages.  
Also, when the PCB 45 and the TCP 14 are lifted to insert the digitizer, the TCP 14  
connected to the PCB 45 is contacted with the top case 20 and cracked. Particularly,  
the number of inferior goods are increased when having the S,G-PCB 45. Furthermore,  
in case an end of the top case 20 has a burr having a kin end because an end of a top  
20 case contacting with the TCP is inferior, the damage of the TCP is accelerated.

Also, the PCB is screwed remaining a predetermined space between the support main and the PCB so as to insert the digitizer into the space according to a conventional art.

## **[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]**

However, the related art LCD with digitizer has the following problems.

- If the separate digitizer is mounted to the rear of the LCM, the thickness of the LCD device is increased in correspondence to the thickness of the digitizer. That is,
- 5 it causes the problem in the LCD device for requiring the thin profile and lightness.

When inserting the digitizer between the LCM and the PCB, the PCB is lifted.

Also, on insertion of the digitizer, the PCB and the TCP are damaged, thereby increasing the inferior goods.

- Accordingly, the present invention is directed to an LCD device with a
- 10 digitizer that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide an LCD device having a stable insertion structure of a digitizer to an LCM, which is suitable for obtaining thin profile and lightness of the LCD device, and improving yield.

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## **[PREFERRED EMBODIMENTS OF THE INVENTION]**

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, an LCD device with a digitizer includes a support main receiving an LCD panel for displaying image,

20 and a backlight for providing light to the LCD panel; a lamp for emitting light, provided at one inner side of the support main; a light-guiding plate, provided adjacent to the lamp, for uniformly irradiating the light emitted from the lamp to an upper side; a digitizer having an upper surface of reflecting means, provided below the light-guiding plate; and a lamp housing having one opening adjacent to the light-guiding plate,

provided in state of surrounding the lamp, wherein each one end of the light-guiding plate and the digitizer is inserted to the opening of the lamp housing.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

5 Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

FIG. 4 is a cross-sectional view illustrating an LCD device with a digitizer 40 forming a reflecting means at a portion adjacent to a lamp housing 26 according to the present invention. At this time, the light is incident on a bottom of an LCD panel 11 in 10 order to displaying a picture image, and a backlight emits the light. The backlight is comprised of a lamp 25, a lamp housing 26, a light-guiding plate 12b, and a plurality of sheets 12.

As shown in FIG. 4, the lamp 25 is provided at one side of a support main 13 along a long-axis direction of an LCM 10. Generally, the lamp 25 is a cold cathode 15 fluorescent lamp (CCFL). That is, the lamp 25 emits light, and then the light is condensed by the lamp housing 26 covering the lamp 25 and having the reflective surface, and the condensed light is incident on the side of the light-guiding plate 12b. The light-guiding plate 12b uniformly guides the light. Then, the light emitted from the upper surface of the light-guiding plate 12b is incident on the LCD panel 11 through 20 the diffusion, protection and prism sheets 12. By the incident light through the LCD panel 11, the picture image is realized.

When assembling the backlight of an LCM 10, the digitizer 40 is assembled in state of inserting one end thereof to the lamp housing 26. Herein, the digitizer 40 uses a sensor for detecting a touching point of an electron (stylus) pen according to an

EM mode. Thus, it is unnecessary to position the digitizer 40 at the front of the LCD panel 11. That is, the digitizer 40 is provided inside the backlight of the LCM 10, and a reflective coating process is performed to an inner surface of the lamp housing 26. Also, the lamp housing 26 has an opening at a portion adjacent to the light-guiding plate 12b. Then, the light-guiding plate 12b is provided on the digitizer 40, and each one end of the digitizer 40 and the light-guiding plate 12b is inserted into the opening of the lamp housing 26.

In this state, it is required to form the reflecting means on a lower surface of the light-guiding plate 12b for preventing the light from leaking to the external. That is, the light is reflected to an upper side by the reflecting means. In the related art, an additional reflecting plate is provided on the lower surface of the light-guiding plate 12b, whereby the reflecting plate reflects the light to the upper side. However, the reflecting plate is positioned at the lowest surface of the support main 13, so that an additional supporter is required to prevent the reflecting plate from being damaged due to foreign materials or contact, or to fix the reflecting plate. That is, the reflecting material is deposited on the reflecting plate, and a stiffener such as paper is provided to the bottom of the reflecting plate, whereby the reflecting plate becomes thick.

Generally, the digitizer 40 is formed of PCB for forming the external at a predetermined thickness, so that an upper surface of the digitizer 40 is provided as the reflecting means 40a, thereby obtaining the thinner profile as compared to that in case of assembling the separate reflecting plate and the digitizer 40. Thus, in the present invention, the reflecting means 40a is provided on the upper surface of the digitizer 40 mounted to the backlight.

The structure of the digitizer 40 having the aforementioned structure will be

described in more detail. In the preferred embodiment of the present invention, the reflecting means 40a is provided on the upper surface of the digitizer 40 mounted to the backlight according to the present invention. Hereinafter, the detailed structure of the aforementioned digitizer will be described as follows.

5       In one preferred embodiment of the present invention, the reflecting means 40a forming the upper surface of the digitizer 40 is formed of a reflecting plate. That is, the reflecting plate substitutes for the upper surface of PCB forming the external of the digitizer according to the related art. Thus, in order to form the upper surface of the digitizer 40 as the reflecting plate when assembling the digitizer 40, an upper  
10 surface of a plastic supporter forming the external of the PCB of the digitizer is formed of the reflecting plate. As compared to the related art for forming the separate reflecting plate, and mounting the reflecting plate on the digitizer 40, the present invention makes it possible to decrease a thickness corresponding to the supporter for the separate reflecting plate according to the related art. Also, the digitizer 40 is  
15 inserted to the lamp housing 26 in the preferred embodiment of the present invention, so that the upper surface of the digitizer 40 serves as the reflecting plate.

In another embodiment of the present invention, the reflecting means 40a of the digitizer 40 is formed of a reflecting sheet on the upper surface of the digitizer 40. The reflecting sheet is formed on an upper case of the digitizer 40, and it is not required  
20 to form an additional supporter. Thus, it is possible to obtain the thinner profile as compared to that in case for separately forming the digitizer 40 and the reflecting plate, and assembling the same according to the related art.

In another embodiment of the present invention, a reflecting material is deposited on the upper surface of the digitizer 40 for the reflecting means 40a of the

digitizer 40. Also, the reflecting material has great reflectivity. At this time, it is possible to deposit the reflecting material on the upper surface of the digitizer 40 with the same material as that according to the related art. Also, the deposition surface of the reflecting material is not limited to the upper surface of the digitizer 40. Preferably,  
5 the reflecting material is deposited in the portion, to which the light of the lamp 25 is directly irradiated, at one end of the digitizer 40 inserted to the lamp housing 26, for preventing the light from leaking. Accordingly, in the digitizer 40 having the reflecting means 40a according to the present invention, it is possible to decrease the thickness of the backlight, thereby obtaining the thin profile and the lightness of the  
10 LCD device.

Meanwhile, it is required to maintain the digitizer 40 inserted to the lamp housing 26 at the correct portion not to be moved by the external force. Accordingly, one end of the digitizer 40 having the light-guiding plate 12a and the reflecting means 40a is inserted to the opening of the lamp housing 26 for the stable fixation of the  
15 digitizer 40, whereby the digitizer 40 is clamped by the lamp housing 26. Referring to FIG. 4, the light-guiding plate 12b is provided directly on the digitizer 40 having the reflecting means 40a, and each one end of the light-guiding plate 12b and digitizer 40 having the reflecting means 40a is inserted to the lamp housing 26. As a result, the digitizer 40 and the light-guiding plate 12b are clamped with the lamp housing 26. At  
20 this time, it is preferable to form the lamp housing 26 of a metal material having elasticity and stiffness.

#### [ADVANTAGES OF THE INVENTION]

As mentioned above, the LCD device with the digitizer according to the present invention has the following advantages.

First, the digitizer is previously assembled into the backlight when assembling the backlight. That is, it is not required to lift up the PCB and TCP for mounting the 5 digitizer at the rear of the LCM, thereby preventing the PCB and TCP from being damaged.

Also, the upper surface of the digitizer is formed for being integrated with the reflecting means, thereby obtaining the thin profile and the lightness of the LCD device according to the present invention as compared to that of the LCD device according to 10 the related art.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

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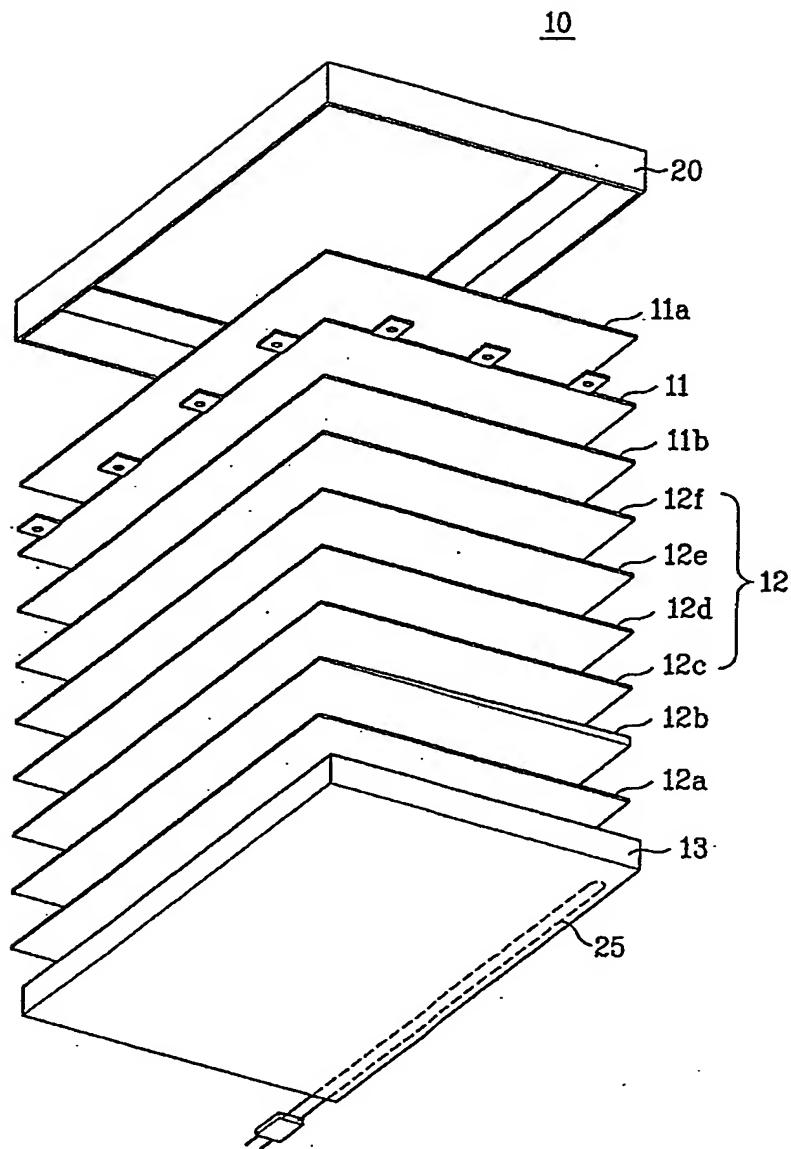
**What is claimed is:**

1. An LCD device with a digitizer comprising:
  - a support main receiving an LCD panel for displaying image, and a backlight for
  - 5 providing light to the LCD panel;
    - a lamp for emitting light, provided at one inner side of the support main;
    - a light-guiding plate, provided adjacent to the lamp, for uniformly irradiating the light emitted from the lamp to an upper side;
    - a digitizer having an upper surface of reflecting means, provided below the
    - 10 light-guiding plate; and
      - a lamp housing having one opening adjacent to the light-guiding plate, provided in state of surrounding the lamp, wherein each one end of the light-guiding plate and the digitizer is inserted to the opening of the lamp housing.
- 15 2. The LCD device with a digitizer of claim 1, wherein the digitizer is a sensor for detecting the coordinates of the predetermined point in an Electromagnetic mode.
3. The LCD device with a digitizer of claim 1, wherein the reflecting means of the digitizer is formed of a reflecting plate.
- 20 4. The LCD device with a digitizer of claim 1, wherein the reflecting means of the digitizer is formed of a reflecting sheet adhered to the upper surface of the digitizer.
5. The LCD device with a digitizer of claim 1, wherein the reflecting means of

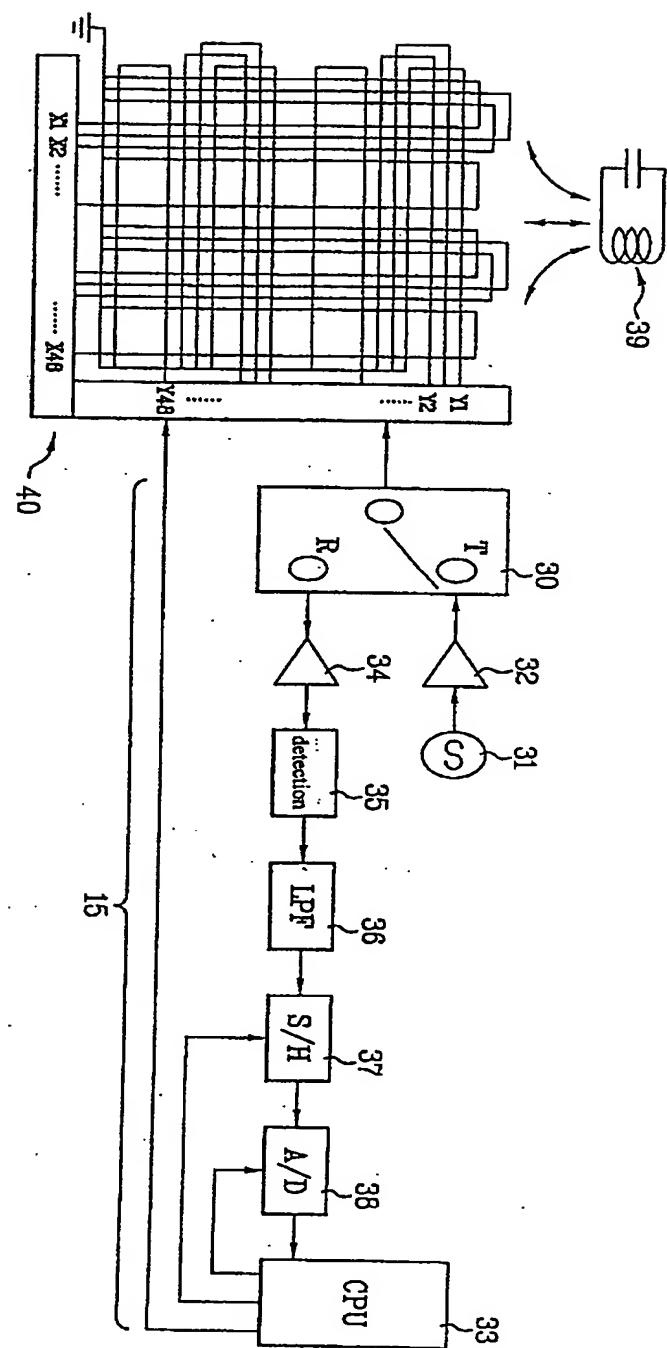
the digitizer is formed of a reflecting material deposited on the upper surface of the digitizer.



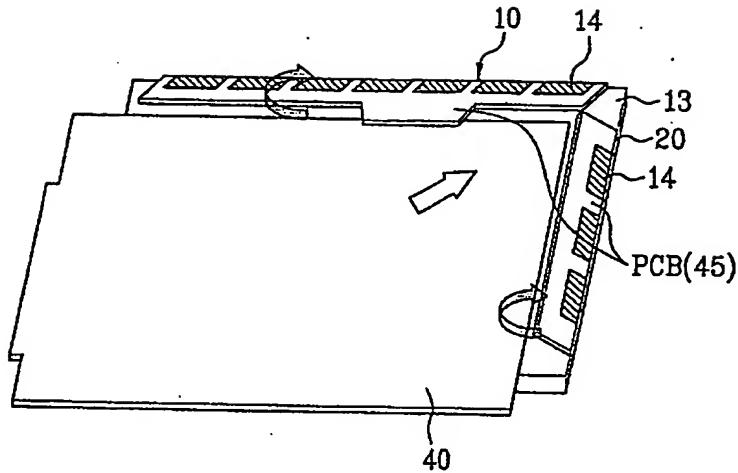
**FIG. 1**



**FIG. 2**



**FIG. 3**



**FIG. 4**

